Introduction: The general public is fascinated by planetary exploration; witness the phenomenal response of the public to the Mars Pathfinder mission – almost 47 million hits on the mission’s website in a single day. [1] Planetaria worldwide host over 63 million visitors each year, and almost 24 million of these planetarium visitors are in the United States—almost one person per eleven U. S. citizens. [2] The general public is definitely interested in planetary exploration and astronomy, but most mission outreach efforts are designed to serve only classroom teachers and students at the K-12 level. These education targets are well served, as any of the current mission websites will clearly show. Emphasis on teachers and K-12 students alone, however, neglects to educate the public at large. This gap can only be partially filled by planetaria; changing how mission planners and mission scientists approach education will help to further close this gap.

Mars missions can directly benefit from early planning of educational efforts. An aggressive education program will make the public better informed when making decisions about funding Mars missions, and will better inform them of the importance of continued planetary exploration.

Limitations of the Present System: There are several limitations to the present system of educating the public about planetary exploration. The most obvious limitation is the lack of emphasis on the general public. This is surprising since the public ultimately funds planetary exploration. Websites can partially ameliorate the problem by giving direct access to information about scientific missions, but not all websites are equally well-designed (the Mars Pathfinder site is considered by web professionals to be an excellent example of what a mission site should be [3]). Also, many people do not have Internet access at home, and little access if any in their local community.

Many planetaria are facilities that serve the general public but they, too, are limited. There are currently only 2504 planetaria worldwide. [2] Given the cost of building and equipping such facilities, it is not likely that this number will increase rapidly in the near future. Planetaria that serve the general public (as opposed to school planetaria) tend to be clustered in urban areas. Even though most of the US population is urban, a sizable fraction of the US population is rural and not in close proximity to a planetarium.

Some planetarians in public-access facilities see themselves as primarily concerned with basic visual astronomy and not planetary exploration. Those that do include planetary science as part of their teaching program may not have access to the most current information. Pre-recorded planetarium shows are difficult to change once they are produced, and these programs are not always replaced in a timely fashion, due to time constraints as well as budgetary considerations. Some planetaria don’t offer live programs at all, relying entirely on pre-recorded programs, which limits the accuracy of the information contained in a particular show to the accuracy present at the time when the show was written.

Discussion: Since the general public has a strong interest in space and planetary exploration, everyone concerned with education should make efforts to capitalize on that interest, including those who are directly involved with planetary missions. The normal educational programs that NASA missions support are not geared to reach the public at large. Here are some methods to correct the gap in public education: educating the planetarium community to improve show quality, and working with local libraries and planetaria to give public presentations about Mars and missions to Mars.

Educating Planetarians: The planetarium community comes from a wide variety of educational backgrounds. Most hold degrees in education, communication, or a science or engineering degree, but not all of them do. Most have experience in amateur astronomy.

As a general rule, planetarians know far more about the space program and about planetary exploration than the general public or science teachers. Planetarians’ knowledge is limited, however, by the lack of direct access to the planetary science community. A planetarian’s knowledge can only be as current as the knowledge that is generally available. Most planetarians do not read the professional science journals because they do not have the background needed to understand the content. Planetarians are, however, a major source of information for the general public on matters concerning planetary exploration. Thus there is a gap between what planetarians know and what they need to know to be effective communicators and educators about planetary exploration. Closer ties between the planetary science and planetarium communities can eliminate this gap. The public would...
benefit from this collaboration because the information content of planetarium programs would be more accurate, and the public would be better informed when making decisions about funding missions to Mars. The planetarium community would benefit through better access to accurate information about Mars exploration. The planetary science community would benefit from access to a network of educators who specialize in science education.

*Educating the Public:* The planetary science community can directly reach out to educate the public through public lectures and presentations. Many planetaria offer live public programs, and most would be willing to host a planetary scientist to discuss his or her work. Public libraries normally offer public lectures at the adult and young adult level, and would appreciate the opportunity to have a planetary scientist speak. Some libraries may offer to host a scientist on a regular basis; one of the authors (Cowles) regularly presents astronomy programs at local libraries, averaging six to eight programs a year. Communicating directly with the public would allow members of the planetary science community to personally explain the significance of their work to the public, to gauge public interest in Mars exploration firsthand, and to help generate media attention for Mars missions.

*Recommendations:* Education efforts should not just be limited to teachers and to students at the K-12 levels. To reach the general public will require a broader base of educational initiatives than are currently available. These new initiatives should involve both the planetary science community and the planetarium community. These initiatives should begin while missions are still in the process of being defined.

A first step would be for planetary scientists and planetarium professionals to meet in a open forum to discuss ways to improve communication between the two groups, and to establish regular communication pathways between them. A series of workshops to educate planetarians about planetary science and to educate scientists on effective methods to teach the general public would be a good way to establish lasting contacts. The planetary science community would gain direct access to a group with specialized skills in presenting information to the public, and the planetarium community would gain access to the group that actively researches the planets and who can provide accurate, up-to-date information.

A second step would be for the planetary scientists to communicate directly with the public about their work. They are the most knowledgeable source of information about their work, for obvious reasons, and they are in the best position to help generate public enthusiasm about planetary exploration. Planetaria and public libraries are two possible venues for direct contact between the planetary science community and the general public. Lectures in a public forum such as a library or a planetarium can be a draw for the media, further enhancing public visibility of Mars missions and helping to further public education efforts.

Early planning for education programs will benefit Mars missions. The public will be better-informed about efforts to understand Mars, why these efforts are important, and—most importantly—why they should continue to receive funding.